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Indian Standard

AUTOMOTIVE VEHICLES — BRAKING SYSTEMS — RUBBER SEAL FOR DISC BRAKE CYLINDER — PERFORMANCE REQUIREMENTS

UDC 629·113-592·117-762·8-036-4 : 620·16

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NEW DELHI 110002

December 1991 **Price Group 3**

Automotive Braking Systems Sectional Committee, TED 4

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Automotive Braking Systems Sectional Committee had been approved by the Transport Engineering Division Council.

Braking systems components play a very vital role in the functioning of a vehicle. This standard specifies the performance requirements for seals used in disc brake cylinders. Disc brake systems are being introduced into Indian automotives particularly two wheelers, passenger cars and commercial vehicles.

In the formulation of this standard, assistance has been derived from the following publications:

SAE J 1603-1985 Rubber seals for hydraulic disc brake cylinders, issued by Society of Automotive Engineers, USA

JIS D 2609-1982 Elastomeric seals of hydraulic disc brake cylinders for automobiles, issued by Japanese Industrial Standards Committee, Japan

AMENDMENT NO. 1 APRIL 2008
TO
IS 13249 : 1991 AUTOMOTIVE VEHICLES — BRAKING SYSTEMS — RUBBER SEAL FOR DISC BRAKE CYLINDER — PERFORMANCE REQUIREMENTS

(*Page* 1, *clause* 3.2) — Substitute the following for the existing clause:

'3.2 Each seal shall be suitably packed and the packing slip shall be marked with date of manufacture in code or otherwise.'

(TED 4)

Reprography Unit, BIS, New Delhi, India

Indian Standard

AUTOMOTIVE VEHICLES — BRAKING SYSTEMS — RUBBER SEAL FOR DISC BRAKE CYLINDER — PERFORMANCE REQUIREMENTS

1 SCOPE

This standard describes the performance for elastomeric seals used in automotive vehicles disc brake calipers using a non-petroleum base hydraulic brake fluid. Seals covered under this may be of solid section type (square, rectangular, ring, etc) mounted stationary in cylinder bore or on the movable portion of disc brakes. The seals are intended for temperature working conditions between – 40°C and 120°C.

2 REFERENCE

IS 8654 : 1986 'Automotive hydraulic brake fluid, heavy duty (*first revision*)', is a necessary adjunct to this standard.

3 GENERAL REQUIREMENTS

3.1 The seals shall have good surface finish and free from inclusions and other harmful defects, such as, bubbles, cracks, burrs, etc.

3.2 Each seal shall be marked with the date of manufacture in code or otherwise.

4 PERFORMANCE REQUIREMENTS

4.1 The seal performance when tested in accordance with the procedures outlined in Annexes A to G shall comply with the requirements given in **4.2** to **4.9**.

4.1.1 If agreed to between the purchaser and the supplier, leakage test for the seals may be carried out at the maximum design pressure.

4.2 Resistance to Fluid at Elevated Temperatures — Stability

4.2.1 When tested as per Annex A the change in volume shall not exceed 15 percent of initial value and the change in hardness shall not be less than – 15 IRHD.

4.3 Resistance to Fluid at Elevated Temperatures — Precipitation

4.3.1 When tested as per Annex B the sediment precipitation shall not be more than 0·05 percent in volume.

4.4 Resistance to Elevated Temperature in Dry Air

4.4.1 When tested as per Annex C the change in IRHD hardness shall not exceed 15 points of original value and the seal condition after the test shall show no evidence of tackiness, blistering, cracking or change in shape from its original appearance.

4.5 Ambient Temperature — Stroking Test

4.5.1 When tested as per Annex D the parts and assembly, after the test, shall show no leakage beyond normal wetting of bore during the stroking test as well as during the static leak test.

4.6 High Temperature — Stroking Test

4.6.1 When tested as per Annex E the parts and assembly, after the test, shall show no leakage beyond normal wetting of bore during the stroking test as well as during the static leak test.

4.7 Low Temperature — Leakage Test

4.7.1 When tested as per Annex F the parts and assembly, after the test, shall show no leakage beyond normal wetting of bore during the test period or pressure application. The seal shall not crack and shall show evidence of rubber like quality during the flexibility bend test.

4.8 Cycling Humidity — Storage Corrosion Test

4.8.1 When tested as per Annex G the parts and assembly after the test shall show no evidence of rubber adhesion of the test seal during disassembly of the test brake.

4.8.2 After the test as per Annex G the surfaces of sealing systems shall show no evidence of corrosion or deterioration which would interfere with proper sealing action. Normal staining or discolouration of metal parts is acceptable if surface finish is unaffected.

4.9 The normal wetting shall not be to the extent of any drop formation for tests as per **4.5**, **4.6** and **4.7**.

ANNEX A

(*Clauses* 4.1 *and* 4.2.1)

RESISTANCE TO FLUID AT ELEVATED TEMPERATURES — PHYSICAL STABILITY

A-1 TEST SPECIMENS — three seals.

A-2 TEST PROCEDURES

A-2.1 Determine and record initial volume of each seal by finding out the difference between weight in air and weight in water.

A-2.2 Determine and record initial IRHD hardness of the test seal using a microtester.

A-2.3 Test specimen shall be placed in a suitable glass container and completely immersed in 75 ml of brake fluid conforming to IS 8654 : 1986, the container being closed to prevent vapour loss and placed in an oven at 120 ± 2°C for 70 hours.

A-2.4 At the end of the heat soaking, allow the test seals to cool to ambient conditions, rinse with isopropyl alcohol or ethyl alcohol and wipe dry. Seals shall not remain in the alcohol for more than 30 seconds. Determine and record the final volume and hardness (IRHD) of each seal.

A-3 TEST REPORT

A-3.1 The change in volume shall be reported as percentage of the initial volume.

$$\text{Percentage increase in volume} = \frac{(W_3-W_4)-(W_1-W_2)\times 100}{(W_1-W_2)}$$

where

W_1 = initial weight in air, g;
W_2 = initial weight in water, g;
W_3 = weight in air after test, g; and
W_4 = weight in water after test, g.

ANNEX B

(*Clauses* 4.1 *and* 4.3.1)

RESISTANCE TO FLUID AT ELEVATED TEMPERATURE — PRECIPITATION CHARACTERISTICS

B-1 TEST SPECIMEN — three seals.

B-2 TEST PROCEDURE

B-2.1 Immerse the test specimen in 75 ml of sample fluid conforming to IS 8654 : 1986 in a closed container and keep in an oven at a temperature of 120 ± 2°C for 70 hours.

B-2.2 After 70 hours remove the container from the oven. The seals shall remain in the fluid for 24 hours, after which the test fluid is agitated and poured into a cone shaped centrifuge tube.

B-2.3 Rotate the tube for 60 minutes at 1 500 rev/min. Note the volume of sediment in the tube.

B-3 TEST REPORT

B-3.1 The percentage of sediment shall be reported.

ANNEX C

(*Clauses* 4.1 *and* 4.4.1)

RESISTANCE TO ELEVATED TEMPERATURES IN DRY AIR

C-1 TEST SPECIMEN — two or more seals.

C-2 TEST PROCEDURE

C-2.1 Determine and record initial IRHD hardness using a micro tester.

C-2.2 The test seals are placed in a circulating oven at a temperature 175 ± 2°C for 22 hours.

C-2.3 At the termination of the heating period the seals shall be removed from the oven and allowed to cool to room temperature.

C-3 TEST REPORT

C-3.1 Measure and record IRHD hardness.

ANNEX D

(*Clauses* 4.1 *and* 4.5.1)

AMBIENT TEMPERATURE STROKING TEST

D-1 TEST SPECIMEN

Adequate number of seals for at least one complete caliper assembly.

D-2 TEST PROCEDURE

D-2.1 Assemble the seals inside the caliper taking the normal precautions, keeping the piston to simulate half worn lining position.

D-2.2 Assemble the test caliper assembly to a simulating fixture and connect the fixture to pressure source. It may be necessary or desirable to include a fluid accumulator.

D-2.3 Leakage Test

Observe leakage during and after stroking test. After completion of the stroking test, run high and low pressure leak test.

D-2.3.1 *High Pressure Leak Test*

After 0·7 MPa hydraulic pressure for five minutes and observe and record leakage if any.

D-2.3.2 *Low Pressure Leak Test*

Remove the caliper from the test stand and connect the test caliper to a pressure source of 10 ± 1·7 kPa for 24 hours. Observe leakage; if any. The low pressure source may be a static column of fluid of length of 1 200 mm long.

D-3 TEST CONDITIONS

D-3.1 Temperature, 15 to 45°C.

D-3.2 Pressure

Pressure shall be applied by an external means at a maximum rate of pressure rise of 21·0 ± 1·4 MPa/s from 0 to 7·0 ± 0·3 MPa.

D-3.3 Cycles Required — 500 000.

D-3.4 Cycle Rate — 1 000 + 100 cycles per hour maximum.

D-3.5 Brake fluid used shall conform to IS 8654 : 1986.

ANNEX E

(*Clauses* 4.1 *and* 4.6.1)

HIGH TEMPERATURE STROKING TEST

E-1 TEST SPECIMEN

Adequate number of seals for at least one complete caliper assembly.

E-2 TEST PROCEDURE

E-2.1 Assemble the seals inside the caliper, taking the normal precautions, keeping the piston to simulate half worn lining position.

E-2.2 Assemble the test caliper assembly to a simulating fixture as given in Fig. 1.

E-2.3 After 70 h, discontinue stroking, shut off heat, open oven door, release hydraulic pressure in system and allow oven to cool for 60 min.

E-2.4 After 60 min cooling period, remove the test assembly and allow to complete cooling to room temperature in open air.

E-3 TEST CONDITIONS

E-3.1 Oven Temperature — 120 ± 2°C.

E-3.2 Pressure — 7 ± 0·3 MPa *Max.*

E-3.3 Elapsed Time — 70 hours.

E-3.4 Cycles Required — 70 000 ± 5 000.

E-3.5 Rate of Pressure — 7·0 MPa/s and a minimum dwell period of 0·25 s below 0·18 MPa.

E-4 LEAKAGE TEST

E-4.1 Observe leakage during and after the 70 h stroking test. After cooling commence high and low pressure leakage test.

E-4.2 High Pressure Leakage Test

Apply 0·7 MPa hydraulic pressure for 5 min and observe and record leakage, if any.

E-4.3 Low Pressure Leakage Test

Remove the caliper from the test caliper to a pressure source of 10 ± 3·3 kPa for 24 h. Observe leakage if any. The low pressure source may be a static column of fluid 1 200 mm long.

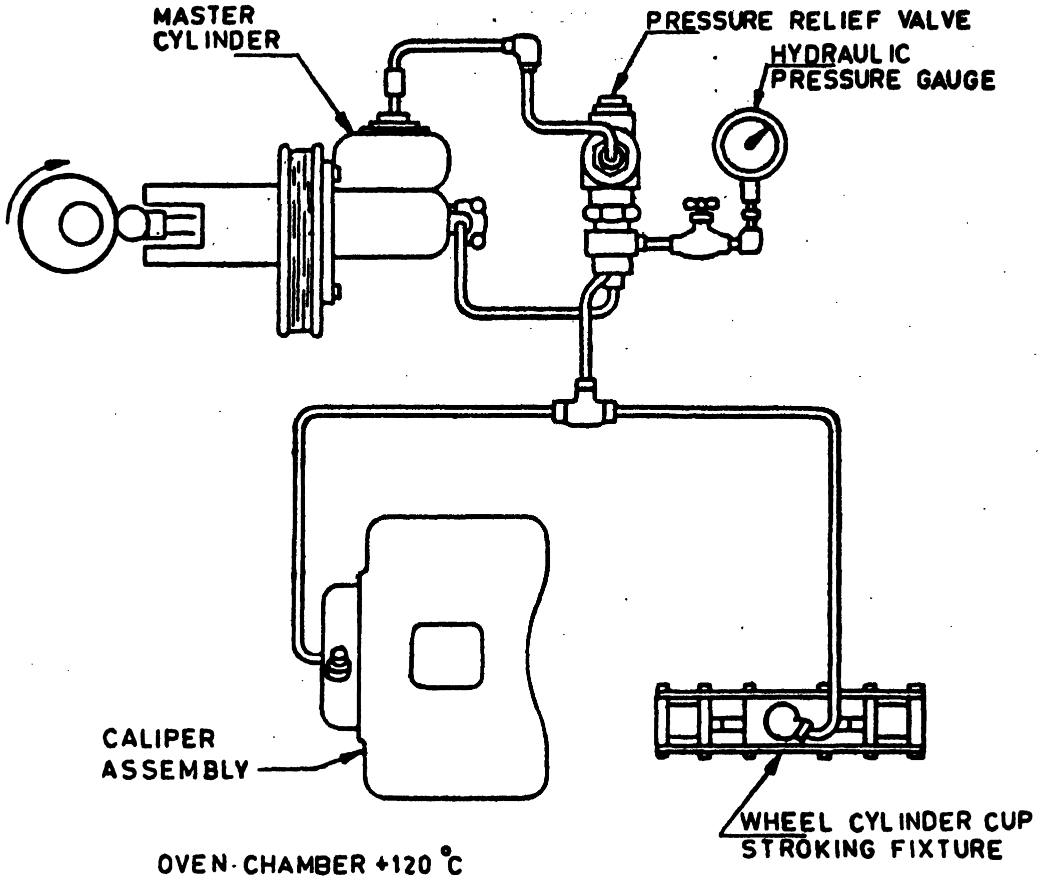

FIG. 1 HIGH TEMPERATURE STROKING TEST

ANNEX F

(*Clauses* 4.1 *and* 4.7.1)

LOW TEMPERATURE LEAKAGE TEST

F-1 TEST SPECIMEN

Adequate number of seals for at least one complete caliper assembly.

F-2 TEST PROCEDURE

F-2.1 Assemble the seals inside the caliper taking normal precautions. Accommodation shall be made to change the piston position during the cold test to simulate new, half, two-thirds and totally wornout lining positions.

F-2.2 Assemble the caliper assembly to a simulating fixture as given in Fig. 2 in a cold chamber at −40°C to −43°C connect to a pressure source.

F-2.3 Allow the caliper to soak for 72 h with piston in new lining conditions.

F-2.4 The actuating mechanism shall than be stroked for six times each at a pressure of 1 ± 0·07 MPa and 4·2 ± 0·35 MPa respectively. The stroking shall be for 5 s with an interval of 60 s in between each stroke.

F-2.5 Immediately afterwards change the piston to half worn-out lining condition. The piston shall be moved with minimum hydraulic pressure required for piston movement to establish new locating position for all pistons. Examine and record any leak, if any, 30 min after the piston movement. Keep the above in low temperature for 24 hours.

F-2.6 Repeat F-2.4 after a total of 96 hours.

F-2.7 Change the semi-wornout pad condition to 2/3 wornout condition and carry out F-2.5.

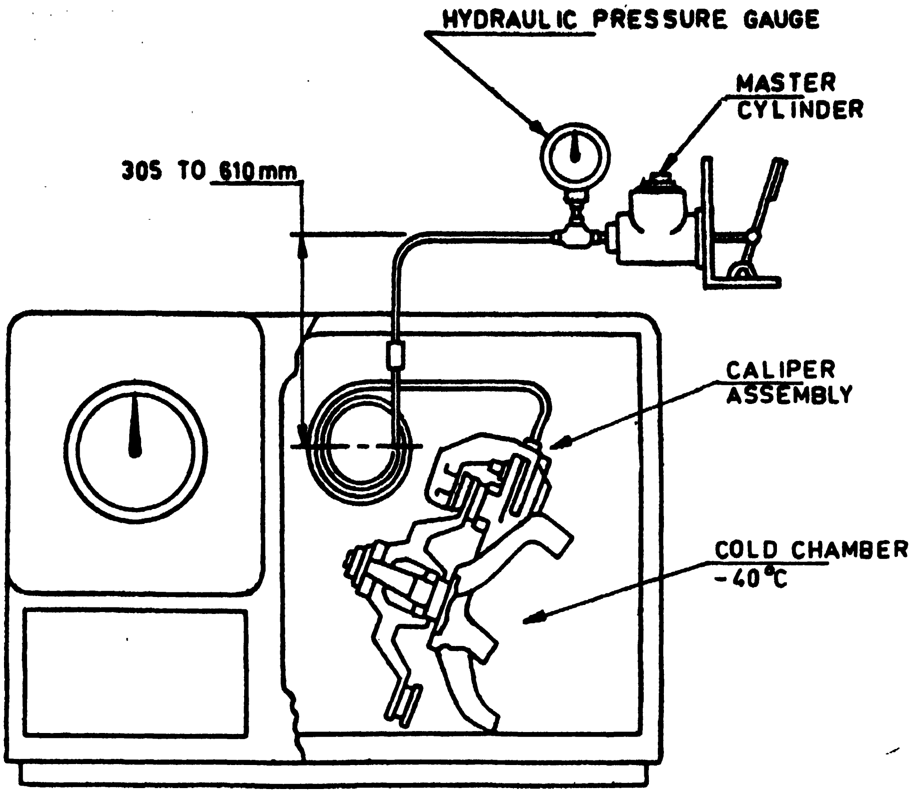

FIG. 2 LOW TEMPERATURE LEAKAGE TEST

F-2.8 Repeat **F-2.4** after a total of 120 hours.

F-2.9 Changing the pad to a fully wornout pad, move the piston same way as in **F-2.5** and after 30 min examine and record any leak.

F-3 LOW TEMPERATURE BEND TEST

F-3.1 Place one seal in a cold chamber at −40°C to −43°C for 22 hours.

F-3.2 After 22 hours the seal shall be folded back upon itself between the thumb and finger and released within 2 to 5 s. The cold seal shall be folded while in cold chamber. Check the condition when it comes back to its original shape. Returning it to room temperatures, examine the surface for flaw such as cracks, etc. Use gloves for bending to avoid conduction of body heat.

ANNEX G

(*Clauses* 4.1 *and* 4.8.1)

CYCLING HUMIDITY STORAGE CORROSION TEST

G-1 TEST SPECIMEN

Adequate number of seals for at least one complete caliper assembly.

G-2 TEST PROCEDURE

G-2.1 Assemble the seals inside the caliper taking the normal precautions, keeping the piston to simulate half worn lining position — wetting of seals and caliper with the assemble fluid recommended by the manufacturer.

G-2.2 Place the test caliper in a humidity chamber capable of 95 percent relative humidity and a temperature range of 21°C to 46°C. The caliper shall be placed with inlet port open and facing down.

G-2.3 Hold the caliper at 43°C to 46°C and 95 percent relative humidity for 16 hours.

G-2.4 Change the temperature to 18°C to 21°C at the same humidity and hold for 8 hours.

G-2.5 Continue the above 24 h cycle for 12 days.

G-2.6 At the conclusion of the 12 day test, remove the test caliper for disassembly and inspection. Do not rotate caliper and where possible disassemble while holding in the test position.

G-3 TEST REPORT

G-3.1 Inspect and note all components for corrosion, pitting, adhesion and other deleterious factors resulting from corrosion and/or interaction between the materials involved.

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